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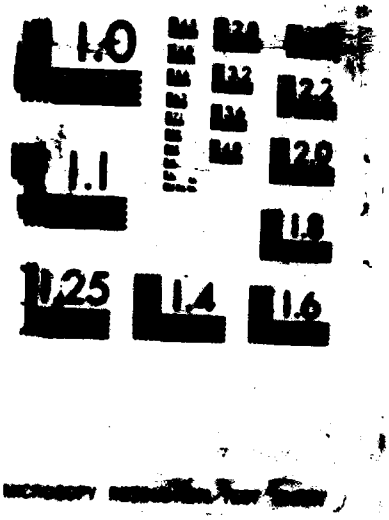
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ECONOMIC ANALYSIS (EA) SUPPORT FOR AUTOMATED INFORMATION SYSTEM CONTROL BOARD (AISCB) WORKING GROUP

CATALOGING-TOOLS-ON-LINE (CTOL)

AUTOMATED INFORMATION SYSTEM (AIS)

ECONOMIC ANALYSIS

PART I

AUGUST 1986

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Current DLA cataloging operations use a manual information system to prepare new item requests and maintain existing cataloging transactions. This economic analysis assesses the economic feasibility of replacing the current manual operations with a CTOL Automated Information System (AIS). In the economic analysis, comparison analyses of costs and benefits are done between the current method of operation and the CTOL AIS proposal. Sensitivity analyses are performed on significant costs of the AIS proposal in order to address uncertainty in future cost estimates and to determine what effect any variation in these costs will have on the payback period. Recommendations are made based on the results of the economic analysis.

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Economic Analysis (EA) Support For Automated Information System Control Board (AISCB) Working Group

Part I

Cataloging-Tools-On-Line (CTOL) Automated Information System (AIS) Economic Analysis

August 1986

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5 AUG 1987

DLA-LO

FOREWORD

Current DLA cataloging operations use a manual information system to prepare new item requests and maintain existing cataloging transactions. This economic analysis assesses the economic feasibility of replacing the current manual operations with a Cataloging-Tools-On-Line (CTOL) Automated Information System (AIS) as a part of the Standard Automated Materiel Management System (SAMMS) modernization.

In the economic analysis, comparison analyses of costs and benefits are done between the current method of operation and the CTOL AIS proposal. Sensitivity analyses are performed on significant costs of the AIS proposal in order to address uncertainty in future cost estimates and to determine what effect any variation in these costs will have on the payback period. Recommendations are made based on the results of the economic analysis.

The results of the economic analysis show that the CTOL AIS is economically feasible. This economic analysis was performed on the first phase only of a three phase plan to enhance the overall efficiency of the Federal Catalog System. In addition, this economic analysis will serve as an example for future AIS economic analyses performed by the Integrated Priority List (IPL) Working Group members.

B. W. COOK
Captain, SC, USN
Acting Deputy Assistant Director
Policy and Plans

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EXECUTIVE SUMMARY

A major goal of the Standard Automated Materiel Management System (SAMMS) is to improve the Federal Catalog System's overall efficiency. Part of this goal is to improve SAMMS support to the four hardware Defense Supply Centers (DSCs) and the Defense Personnel Support Center (DPSC). Thus, a Cataloging Tools On-Line (CTOL) Automated Information System (AIS) is under consideration. This state-of-the-art system is designed to include minicomputers with optical storage and workstations consisting of video display terminals, keyboards, and magnetic disk storage.

This study provides a cost/benefit analysis of such a system. Two alternatives are considered: the current manual system in Supply Center cataloging operations, and the CTOL AIS. The analysis time horizon is 15 years (FY86-00). Costs are stated in FY86 dollars.

Total discounted life-cycle costs for the current operation are $118,410,000; this includes costs for Four-Phase equipment replacement, personnel, equipment maintenance, and supplies. Discounted life-cycle costs for the CTOL AIS are $110,519,000; this includes costs for ADPE, equipment replacement, site preparation, software development, contractor support, training, and residual value of replaced equipment. The CTOL AIS has a life-cycle savings/investment ratio of 1.64; its operating cost savings will allow full recovery of its initial investment costs within 9.0 years, or 5.0 years after full operation begins. The CTOL AIS will require an estimated 139 fewer personnel to support Supply Center cataloging operations.

A sensitivity analysis reveals that CTOL is economically preferable to the current environment so long as:

1. Initial CTOL AIS investment costs are less than $24,286,000. (The study best estimate is $13,820,000.)

2. Useful life of ADPE is at least six years. (The study best estimate is eight years.)

3. CTOL personnel requirements do not exceed the study's best estimate (373 personnel, costing $10,692,000 annually) by more than 15%, i.e., an additional 55 personnel equivalents, costing an extra $1,577,000 annually.

Beyond its quantified life-cycle cost advantage, CTOL would offer the following advantages over the current operation:

1. Improved processing time.

2. Reduced administrative leadtime (ALT).

3. Interface capabilities.

4. Improved work quality and control.

I. OBJECTIVE. The objective is to analyze the economic feasibility of a Cataloging Tools On-Line (CTOL) Automated Information System (AIS) as an integral part of the modernization of the Standard Automated Materiel Management System (SAMMS). Major aims of the CTOL application are to improve processing time, work quality, and work control.

II. BACKGROUND. Currently, in cataloging operations at the four Defense Hardware Supply Centers and the Defense Personnel Support Center (DPSC), the development of item identifications for new National Stock Number (NSN) requests and maintenance to existing item supply are primarily manual operations. These manual operations require significant personnel resources and long administrative leadtimes. Thus, the Cataloging Tools On-Line Automated Information System is being proposed to replace the current manual system. The various "cataloging tools" (or reference data) used in cataloging operations include engineering drawings, Federal Item Identification Guides, Government Industrial Specification Standards, commercial catalogs, cataloging handbooks and the Defense Integrated Data System (DIDS) Procedures Manual (DoD 4100.39-M, Vol. 10), which includes multiple application references, instructions, tables, and grids. Implementation of the CTOL AIS will not change the work to be done, but it will completely change the methods used to accomplish this work. The economic considerations of two alternatives, the current manual system and the proposed automated system, will be addressed.

III. ALTERNATIVES

Alternative A is the current manual system utilized in cataloging operations. Current operations require a large volume of paperwork passing through multiple steps of several manual processes. These processes involve manual completion, review, and control of transactions. Production and management reports are also produced manually. The Four-Phase equipment provides the only automation under this system and is used for data entry alone. As a manual operation, the current procedures work satisfactorily, but the current system may not be adequate to support the volumes of data needed if future workload increases appreciably[6]. Under this system, the "cataloging tools" are recorded on microfiche, hardcopy, and 35 millimeter film.

Alternative B is the proposed CTOL Automated Information System for cataloging operations. The CTOL AIS will use state-of-the-art technology including minicomputers with optical storage and workstations (video display terminals and keyboards)[1,5]. It will be capable of supporting cataloging operations at Defense Construction Supply Center (DCSC), Defense Electronics Supply Center (DESC), Defense General Supply Center (DGSC), Defense Industrial Supply Center (DISC), and DPSC. The hardware configuration is sized to handle a three-fold workload increase over the CTOL AIS operating life. The CTOL will interface with numerous databases including Defense Integrated Data System's Total Item Record (DIDS TIR), Technical Information Storage and Control Application (TISCA), and the Provisioning Control File. The on-line access to "cataloging tools" databases will be accomplished through the workstations. The cataloging technicians at each workstation will be able to access, select, review, and copy designated databases directly. The automated system will store, process, and transmit data. Data to be stored in the automated system will consist of both graphic and text data. It will be input by keystroking, scanning, and magnetic disk/tape. Data to be processed will consist of cataloging transactions developed on-line at the workstations. Data to be

transmitted will consist of catalog transactions developed at workstations and transmitted to [redacted], interrogation requests/replies to and from above-mentioned databases, periodic maintenance to CTOL databases transmitted from [redacted] Logistics Support Center (DLSC) to DSCs and DPSC over AUTODIN, and [redacted] data.

IV. [redacted]. The assumptions of this economic analysis are as follows:

A. The project life for the CTOL AIS is 15 years beginning in FY86. [redacted] is being designed to accommodate the Centers' cataloging needs [redacted][3].) The first four years are leadtime years.

B. The useful life of the ADP equipment is eight years.

C. Workload for Item Identification/Cataloging will remain constant throughout the life cycle.

D. No military construction will be required.

E. Four-Phase equipment currently being utilized has no residual value.

F. Replacement of Four-Phase equipment, necessary in project year 3 if current operations continue, will not be replaced that year if Alternative B is selected[15].

G. There will be no increase in personnel requirements during the life of the project.

H. A 10% management overhead cost is included in personnel costs.

I. Processing time required to complete a process in a cataloging transaction is the same at all centers.

J. Maintenance costs for the DLA Minicomputer System ([redacted]) equipment will be the same as the maintenance costs for the Four-Phase equipment[15].

V. [redacted]

A breakdown of both one-time costs and annual recurring costs for both alternatives is presented in Appendix A. The one-time costs are initial investment costs and ADP equipment replacement costs. The investment costs include costs for ADP equipment in both alternatives, plus site preparation and system development costs for Alternative B. System development costs include software development, training, and contractor support. Also, a negative cost is included for residual values of equipment in Project Year 15. Annual recurring costs include costs for personnel, software maintenance, equipment maintenance, travel, and supplies. Table 1 provides a summary of the costs for both alternatives. All discounted costs are stated in FY86 dollars since FY86 is the first year of the project. The standard discount rate is 10%[3].

For the annual recurring costs, since each year's cost is multiplied by a different discount factor, the costs cannot be stated as discounted costs in the Cost Summary Table (Table 1). Therefore, the annual recurring costs under

Alternative B represent annual costs beginning in Project Year 5 (FY90) when the CTOL AIS would be in full operation. During leadtime years 1-2, annual costs are the same for both alternatives. In leadtime years 3-4 of Alternative B, the annual costs are adjusted to account for the partial operation of the AIS as the ADP equipment is installed and application software is developed. The annual costs during the leadtime years are reflected in the cumulative recurring costs.

Table 1

COST SUMMARY ($000)

	Alternative A		Alternative B	
Nonrecurring Costs[8]	Constant Dollars	Discount Dollars	Constant Dollars	Discounted Dollars
ADP Equipment	$ 0	$ 0	$10,100	$ 7,377
Site Preparation	0	0	700	516
System Development	0	0	2,620	2,174
Software Develop/ Training				
Contractor Support	0	0	200	191
Replacement	700	405	10,100	3,070
Travel			200	166
Nonrecurring costs		$ 405		$ 13,494
Less residual value	(131)	(33)	(6,313)	(1,585)
Total nonrecurring costs		$ 372		$ 11,909
Annual Recurring Costs				
Personnel[10,11,14] (Appendix A)	$14,676		$10,692	
Software Maintenance[8]	0		20	
Equipment Maintenance[2,8]	98		200	
Travel[8]	0		2	
Supplies[2]	25		25	
Cumulative Recurring Costs		$118,038		$ 98,611
Total Discounted Costs		$118,410		$110,520

TABLE 2
LIFE CYCLE COSTS ($000)
ALTERNATIVE A

	NON-RECURRING COSTS			RECURRING COSTS					TOTAL COSTS			
PROJECT YEAR	SITE PREPARATION	ADP EQUIPMENT	SYSTEM DEVELOPMENT	PERSONNEL	SOFTWARE MAINTENANCE	EQUIPMENT MAINTENANCE	TRAVEL	SUPPLIES	UNDISCOUNTED COSTS	DISCOUNT FACTOR	DISCOUNTED COSTS	CUMULATIVE DISCOUNTED COSTS
1	0	0	0	14,676	0	93	0	25	14,794	0.954	14,113	14,113
2	0	0	0	14,676	0	93	0	25	14,794	0.867	12,826	26,939
3	0	350	0	14,676	0	93	0	25	15,144	0.788	11,933	38,872
4	0	0	0	14,676	0	93	0	25	14,794	0.717	10,607	49,479
5	0	0	0	14,676	0	93	0	25	14,794	0.651	9,631	59,110
6	0	0	0	14,676	0	93	0	25	14,794	0.592	8,758	67,868
7	0	0	0	14,676	0	93	0	25	14,794	0.538	7,959	75,827
8	0	0	0	14,676	0	93	0	25	14,794	0.489	7,234	83,061
9	0	0	0	14,676	0	93	0	25	14,794	0.445	6,583	89,644
10	0	0	0	14,676	0	93	0	25	14,794	0.405	5,992	95,636
11	0	350	0	14,676	0	93	0	25	15,144	0.368	5,573	101,209
12	0	0	0	14,676	0	93	0	25	14,794	0.334	4,941	106,150
13	0	0	0	14,676	0	93	0	25	14,794	0.304	4,497	110,647
14	0	0	0	14,676	0	93	0	25	14,794	0.276	4,083	114,730
15	0	(1311	0	14,676	0	93	0	25	14,663	0.251	3,680	118,410

TABLE 3
LIFE CYCLE COSTS (0000)
ALTERNATIVE B

PROJECT YEAR	NON-RECURRING COSTS: SITE PREPARATION	ADP EQUIPMENT	SYSTEM DEVELOPMENT	RECURRING COSTS: PERSONNEL	SOFTWARE MAINTENANCE	EQUIPMENT MAINTENANCE	TRAVEL	SUPPLIES	TOTAL COSTS: UNDISCOUNTED COSTS	DISCOUNT FACTOR	DISCOUNTED COSTS	CUMULATIVE DISCOUNTED COSTS
1	0	0	500	14,676	0	93	0	25	15,334	0.954	14,629	14,629
2	0	0	1,079	14,676	0	93	0	25	15,864	0.867	13,754	28,383
3	200	1,900	1,000	14,477	0	113	0	25	17,795	0.788	14,022	42,405
4	500	8,200	330	12,684	0	200	0	25	21,939	0.717	15,730	58,135
5	0	0	0	10,692	20	200	2	25	10,939	0.651	7,121	65,256
6	0	0	0	10,692	20	200	2	25	10,939	0.592	6,476	71,732
7	0	0	0	10,692	20	200	2	25	10,939	0.538	5,885	77,617
8	0	0	0	10,692	20	200	2	25	10,939	0.489	5,349	82,966
9	0	0	0	10,692	20	200	2	25	10,939	0.445	4,868	87,834
10	0	0	0	10,692	20	200	2	25	10,939	0.405	4,430	92,264
11	0	0	0	10,692	20	200	2	25	10,939	0.368	4,026	96,290
12	0	0	0	10,692	20	200	2	25	10,939	0.334	3,654	99,944
13	0	10,100	0	10,692	20	200	2	25	21,039	0.304	6,396	106,340
14	0	0	0	10,692	20	200	2	25	10,939	0.276	3,019	109,359
15	0	(6,313)	0	10,692	20	200	2	25	4,626	0.251	1,161	110,520

VI. COST ANALYSIS

A. Cost Comparison Analysis. Whether to continue with the manually operated system or to convert to an automated data system is analysed by first comparing the total discounted costs for each alternative over the 15-year project life. These life cycle costs are presented in Table 2 for Alternative A and Table 3 for Alternative B.

B. Savings/Investment Ratio (SIR)[3]. To measure the economic soundness of the Alternative B investment, the ratio of the discounted life-cycle annual cost savings to the total discounted AIS investment costs may be calculated. This savings/investment ratio (SIR) compares the cost savings to the investment costs necessary to effect these cost savings. The cost savings of Alternative B include the difference in recurring costs of the two alternatives plus any planned one-time Alternative A costs which may be avoided by implementing Alternative B. If the SIR is equal to one, then the present value of the cumulative investment costs equals the present value of the cumulative cost savings needed to recoup the investment in the proposed AIS. Thus, for an investment to be economically sound, the SIR must be greater than or equal to one. A SIR less than one indicates that the Alternative B investment will never be recouped, in which case, it would not be an economically worthwhile investment. Table 4 shows the calculations for the Alternative B SIR.

Table 4

SAVINGS/INVESTMENT RATIO

Project Year	Investment Costs ($000)	Cost Savings ($000)	
1	540	0	
2	1070	0	
3	3180	179	
4	9030	1885	
5-15		3855	
11		350	(Cost Avoidance)
13	10100		
15	(6313)	(131)	(Alternative A Terminal Value)

$$SIR = PW_{CS}/PW_I$$

$$= \frac{179(.708) + 1885(.717) + 3855(7.900-3.326) + 350(.368) - 131(.251)}{540(.954) + 1070(.867) + 3180(.708) + 9030(.717) + 10100(.304) - 6313(.251)}$$

$$= 1.64$$

Since the SIR is greater than 1.00, the investment is economically sound. In Appendix B, a DoDI 7041.3 Format A-1 is provided as an alternative method of calculating the SIR.

C. Discounted Payback Analysis. The discounted payback period represents the time it takes for Alternative B's cumulative discounted cost savings to recoup the cumulative discounted investment costs[14]. The investment costs represent the sum of the initial and replacement investment costs less the terminal value of investment at the end of the project life. For Alternative B, the discounted payback calculations are presented in Table 5. In the Cumulative Present Value column of Table 5, it can be seen that in Project Year 9, the cumulative cost savings exceed the cumulative discounted investment costs to this point. The discounted investment cost occurring after Year 9 is $1,485,000 ($3,070,000 - $1,585,000). If this is added to the cumulative (discounted) Year 9 investment, $10,424,000, the total is $11,909,000. The cumulative discounted cost savings through Year 9, $11,959,000, are still sufficient to amortize this total. Thus, the payback period for Alternative B is 9.0 years.

VII. SENSITIVITY ANALYSES. Sensitivity analyses should be performed on (1) the dominant costs of the AIS proposal and (2) certain major assumptions made in the EA. These two key factors of the EA contain degrees of future uncertainty and should be tested to see what effect major uncertainties have on the discounted payback. Following are the descriptions and results of the sensitivity analyses.

A. Cost Elements. Sensitivity analyses are performed on two of the cost elements in this economic analysis. They are personnel costs and investment costs for Alternative B. These are performed to determine how the discounted payback period will be affected if variations in the best estimates of the costs should occur over the 15-year project life. While costs for a particular cost element are varied, all other costs are held fixed. Investment and personnel costs were selected for further analysis since they are the dominant costs in the EA and any changes in these costs due to unforeseen circumstances could significantly influence the economic feasibility of the AIS proposal. Graphical representations of the cost sensitivity analyses are provided in Figures 1-2. The following are the descriptions of the cost sensitivity analyses and their results:

1. Alternative B Personnel Costs. Since the state-of-the-art system is new, the number of personnel required to perform various workload actions contains a degree of uncertainty. Thus, personnel costs for the automated system are varied within a ±10% range using increments of 2%. However, the first two years' personnel costs are held constant, since they remain the same as the current system personnel costs. Phasing in of CFOL AIS

TABLE 5

DISCOUNTED PAYBACK CALCULATIONS

PROJECT YEAR	INVESTMENT COSTS ($000)	DISCOUNT FACTOR	DISCOUNTED INVESTMENT COSTS ($000)	CUMULATIVE DISCOUNTED INV. COSTS ($000)	COST SAVINGS ($000)	DISCOUNTED COST SAVINGS ($000)	CUMULATIVE DISCOUNTED COST SAVINGS ($000)
1	540	0.954	515	515	0	0	0
2	1,070	0.867	928	1443	0	0	0
3	3,180	0.788	2,506	3949	179	141	141
4	9,030	0.717	6,475	10424	1,885	1,352	1,493
5	0	0.651	0	10424	3,855	2,510	4,003
6	0	0.592	0	10424	3,855	2,282	6,285
7	0	0.538	0	10424	3,855	2,074	8,359
8	0	0.489	0	10424	3,855	1,885	10,244
9	0	0.445	0	10424	3,855	1,715	11,959
10	0	0.405	0	10424	3,855	1,561	13,520
11	0	0.368	0	10424	4,205	1,548	15,068
12	0	0.334	0	10424	3,855	1,288	16,356
13	10,100	0.304	3,070	13494	3,855	1,172	17,528
14	0	0.276	0	13494	3,855	1,064	18,592
15	(6,313)	0.251	(1,585)	11909	3,274	935	19,526

doesn't begin until Project Year 3. Then the discounted payback period is recalculated for each increment. The results show that if fewer personnel are required to process workload actions under Alternative B, the payback period is reduced. If more personnel are required, the payback period increases. The payback of 9.0 years determined in the economic analysis varies between 6.8 years (-10%) and 14.1 years (+10%) in the sensitivity analysis. If personnel costs had been increased by 12% there would be no payback within the 15-year project life. Results are shown graphically in Figure 1.

2. Alternative B Investment Costs. Changes in the market price of the ADP equipment at time of purchase and changes in equipment requirements are two of several reasons initial and replacement investment costs may contain future uncertainty. This sensitivity test keeps all costs except investment costs fixed and varies investment costs between -25% and +60% in increments of 5%. It is found that the discounted payback varies between 7.3 years and 14.5 years. If investment costs are varied by 65%, no payback during the life of the project exists. In the payback analysis, the discounted investment costs are $11,909,000 and the discounted payback is 9.0 years. The results are presented graphically in Figure 2.

B. Useful Life. The assumption was made in this EA that the useful life of the ADP equipment is eight years[3]. Since the CTOL ADP equipment is state-of-the-art equipment, it is uncertain what the useful life will be. Thus, the variations in the useful life of the equipment are tested to see what the effect will be on the discounted payback period. Equipment replacement costs are incurred in each of the project years immediately following the last year of the useful life of the equipment. That is, replacement costs are incurred more than once if the useful life expires more than once in the project life. The replacement costs of $10,100,000 in Project Year 13 are considered as replacement costs for Project Years 7 through 12. The analysis shows that if the useful life is less than or equal to five years, the discounted payback periods vary significantly from the estimated 9.0 payback. This is because replacement costs would be incurred more than once due to shorter useful lives. If the useful life is greater than or equal to six years, the discounted payback periods vary to a lesser degree. Figure 3 shows the results of the sensitivity analysis for the useful life assumption.

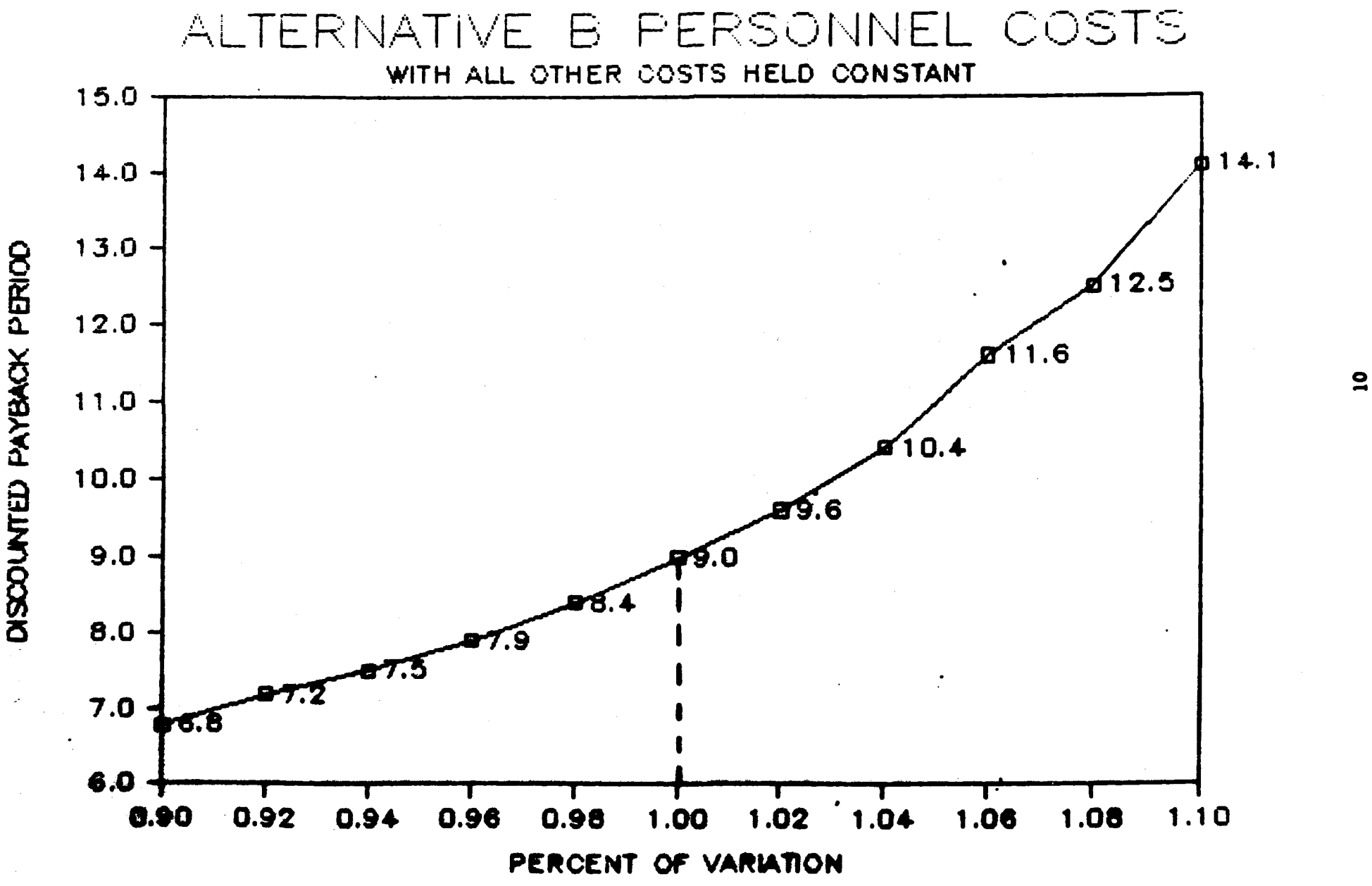
VIII. BENEFITS. A breakdown of quantifiable and nonquantifiable benefits is presented below. The quantifiable benefits include improved processing times, reduced administrative lead times, and future interface capabilities. The nonquantifiable benefits include work quality and work control. The identification of benefits and measurement of quantified benefits are in accordance with the DLA-OSS Functional Development objective and have been approved by the DLA-OSS management [11].

A. Quantifiable Benefits

1. Improved Processing Time

With Alternative A, development and maintenance of catalog transactions are manual processes. For Alternative B, automated steps in the item identification processes allow for faster processing time in preparing item identification data for a cataloging transaction. Faster processing times will allow

Figure 1


ALTERNATIVE B PERSONNEL COSTS
WITH ALL OTHER COSTS HELD CONSTANT
DISCOUNTED PAYBACK PERIOD
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
6.8
7.2
7.5
7.9
8.4
9.0
9.6
10.4
11.6
12.5
14.1
0.90
0.92
0.94
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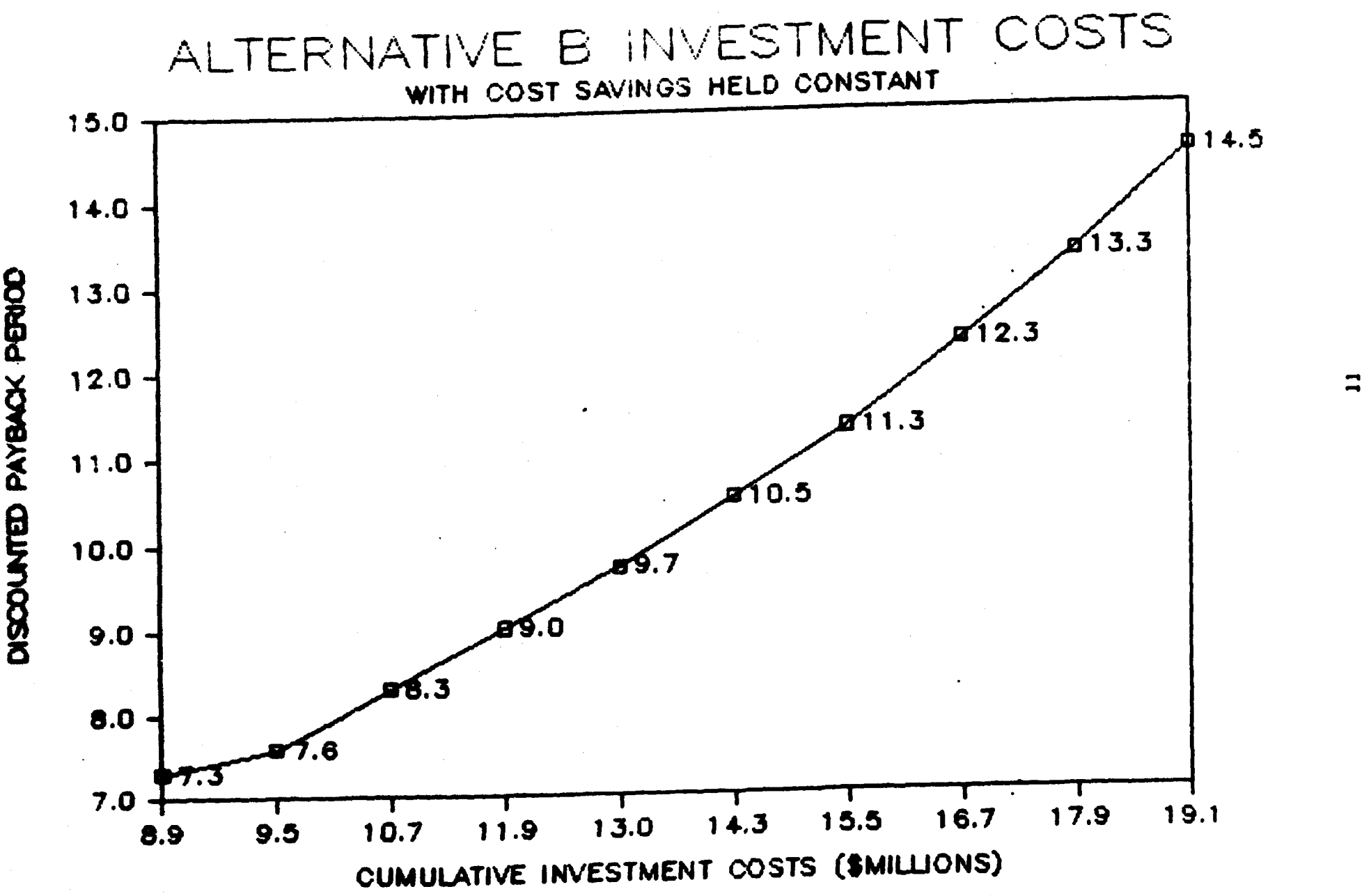
0.98
1.00
1.02
1.04
1.06
1.08
1.10
PERCENT OF VARIATION

Figure 2


ALTERNATIVE B INVESTMENT COSTS
WITH COST SAVINGS HELD CONSTANT
DISCOUNTED PAYBACK PERIOD
15.0
14.0
13.0
12.0
11.0
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9.0
8.0
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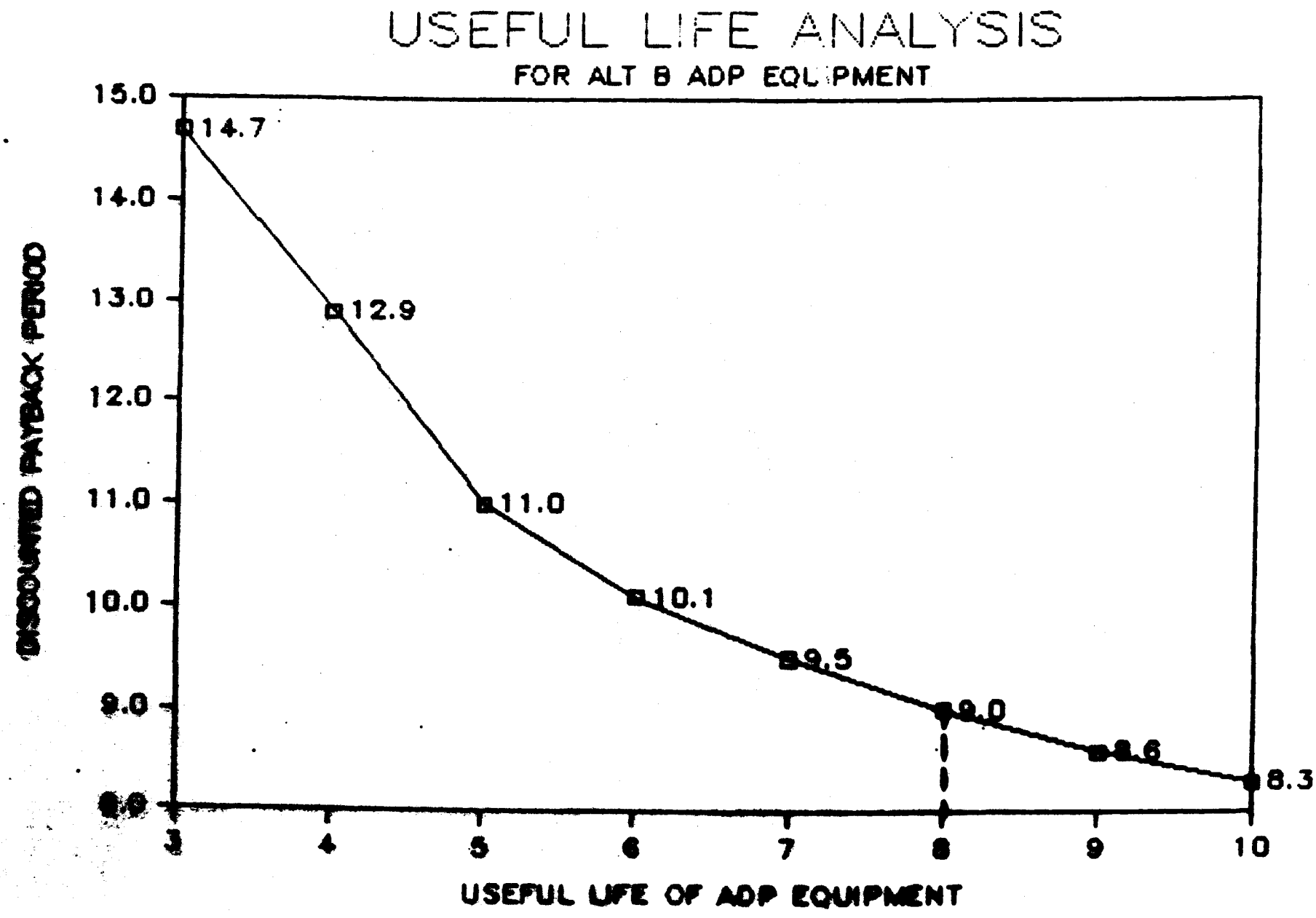
7.3
7.6
8.3
9.0
9.7
10.5
11.3
12.3
13.3
14.5
8.9
9.5
10.7
11.9
13.0
14.3
15.5
16.7
17.9
19.1
CUMULATIVE INVESTMENT COSTS ($MILLIONS)

Figure 3


USEFUL LIFE ANALYSIS
FOR ALT B ADP EQUIPMENT
DISCOUNTED PAYBACK PERIOD
15.0
14.0
13.0
12.0
11.0
10.0
9.0
14.7
12.9
11.0
10.1
9.5
9.0
8.6
8.3
3
4
5
6
7
8
9
10
USEFUL LIFE OF ADP EQUIPMENT

cataloging operations to handle possible increases in future workload and reduce backlogs. Thus, improved processing time will increase response times for military service cataloging needs. Table 6 provides times in hours under both alternatives to complete each item identification process.

Table 6

TIME TO COMPLETE PROCESS IN HOURS

Item Identification Process	Alternative A[13]	Alternative B	Difference (Hrs)
Request	4.2	2.5	1.7
Transfer	1.6	1.2	.4
Revision	1.4	1.1	.3
Cancel	1.6	1.4	.2
Add, Change, Delete	1.0	.8	.2
	9.8	7.0	2.8

For Alternative A, the times were obtained from the DLA Management Engineering Standards (DIMES) Special Purpose Data Standards during November 1983. To calculate time saved under Alternative B, times for those process steps which will be eliminated are totalled[8]. The eliminated steps were identified by DLA-ZSM and functional users through actual observations during May, 1984, of the item identification processes in DGSC cataloging operations.

Through analysis of the times to complete processes and the time saved under Alternative B, the following benefits are derived:

a. Time required for the item identification request process will be reduced from 4.2 hours to 2.5 hours or a 40% time reduction.

b. Time required to enter and edit item identification data for a cataloging transaction will be reduced from 5.6 hours to 4.5 hours or an 20% reduction in time.

c. Overall time required to prepare item identification data for a cataloging transaction will be reduced from 10.0 hours to 7.0 hours or a 30% reduction in processing time.

2. Reduced Administrative Lead Time (ALT). Alternative A requires excessive ALT to obtain new NSNs. Current policies allow 60 days to obtain an NSN. This 60-day timeframe will be significantly reduced by automated processing enhancements and on-line management control of the cataloging transactions. In the Accelerated Cataloging/Mechanized Entry (ACME) Feasibility and Cost Benefit Analysis it was estimated that the 60 maximum days currently required to obtain a new NSN will be reduced to 30 days, a 50% time reduction[2]. Sources of ALT delay under current system include the routine for handling errors, management workload and movement of paperwork.

3. Future Interface Capabilities. The ADP equipment for Alternative B will provide the future capability to electronically interface, from CTOL workstations, with other military services, DSCs, private industry and government agencies equipment for the transfer and receipt of text and graphic data[1].

B. Nonquantifiable Benefits

1. Improved Work Quality. Under current procedures, editing and validation are done separately from data identification and are often done later. When errors are detected by SAMMS, DIDS, or quality control people, the paperwork must be found, error identified, responsibility for correction assigned, and the paperwork sent there. Most of these errors are human errors due in large part to manual processing. In the CTOL AIS work quality will be improved by use of built-in edits to identify errors at time of occurrence in processing cataloging transactions. This will significantly reduce (possibly eliminate) DLSC rejects, thereby eliminating the time required by the cataloging technician to control and process the rejects[1]. The errors will be identified while the cataloging technician still has the work material in hand rather than, as under the current system, after the work material has been filed away.

2. Improved Work Control. Under current procedures, paperwork is used for each step of the cataloging function. To control the paperwork on each item, it is put together as a packet. A significant amount of manpower is required to transfer these packets from one organization to another. Also, data entry is separated from identification of the data to be entered. Data are copied onto worksheets as they are identified and then these worksheets are sent to a separate group for entry. Separation of these duties provides control and efficiency, but it requires a significant amount of manpower to perform the data entry function. Then additional manpower is needed for verification since everything is entered twice. The primary area considered for automation under CTOL is work control in order to reduce the manual processing and control. Then, through use of a complete electronic audit trail, cataloging transactions can be controlled from the time they are received until they are accepted by SAMMS/DIDS. Also, improved production control by use of on-line production, efficiency, quality, backlog and control file aging reports can be realized[1].

IX. BENEFIT ANALYSIS

Table 7 summarizes the incremental importance of the quantifiable benefits which are ranked for both alternatives. The benefits themselves have been assigned factor weights by the functional personnel to establish their relative importance to one another. The benefits are ranked on a scale of 0 to 10 inclusive, where 0 means "of no incremental value" and 10 represents an "attainable ideal". The score for each quantifiable benefit is obtained by multiplying its ranking by the assigned factor weight.

Table 7

ANALYSIS OF INCREMENTAL BENEFITS

Benefit	Factor Weight	Rankings Alternative A	Alternative B
Improved Processing Time	5	0	3
Reduced ALT	4	0	5
Future Interfacing Capabilities	5	0	10

Factor Weight	Significance
5	Extremely important
4	Important
3	Desirable
2	Nice-to-have
1	Minimal impact

The incremental benefit analysis results in a score of 0 for Alternative A because Alternative A is the status quo and therefore obtains no incremental benefit. Alternative B, however, achieved an incremental benefit score of 85 out of a possible score of 140. Thus, based on quantifiable benefits only, the score for Alternative B indicates a potential improvement in cataloging operations.

X. CONCLUSIONS. The objective of this analysis was to assess the economic feasibility of the proposed CPCL AIS. The current manual system is adequate for the current scenario, but it is the finding of this EA that the CPCL AIS is economically and operationally preferable. It will achieve an estimated cumulative discounted cost savings of $19,525,000 in FY 86 dollars over the current system. The number of personnel saved will be 139 (see Appendix A, Table A-3). The AIS will also pay for itself within 5.0 years after full operations begin. A SIR of 1.64 indicates the proposed AIS is an economically sound investment over the full project life cycle. If implemented, it will improve processing times for cataloging transactions and reduce administrative leadtimes for entering new NSNs into the system. Built-in edits to identify errors in cataloging transactions will significantly improve the quality of work. Through the use of an electronic audit trail, cataloging transactions will be controlled from the time they are received until they are accepted by SAMMS/DIDS. The CPCL AIS will also have the capability in the future to electronically interface, from CPCL workstations, with private industry and other government operations to better satisfy the military services cataloging needs.

APPENDIX A

A. Costs

1. Nonrecurring Costs

a. Equipment

The Four-Phase equipment being used under Alternative A can no longer be purchased from the manufacturer. It is also DLA policy not to purchase obsolete equipment. Thus, replacement equipment, which is necessary in Project Year 2, would have to be DLA Minicomputer System (DMINS) equipment. The estimated replacement costs are $350,000[15] with a useful life of eight years. For Alternative B, the cataloging operations are fully automated. The CTOL automated data system will be used by the five Centers and supported by the Defense Logistics Services Center (DLSC) and the DLA Systems Automated Center (DSAC)[11]. The CTOL data processing equipment components consist of scanners, workstations (video display terminals and keyboards), printers and an image management/storage system[9]. The costs stated are in constant dollars and are not discounted. Estimated unit costs[8] of the CTOL ADPE components are as follows:

(1) Workstations, controller, and CPU priced at $10,000.

(2) Printers estimated as low and laser printers at $3,000 each.

(3) Laser disk storage devices to handle data storage requirements estimated at $300,000 each.

(4) Scanners estimated at $70,000 each.

The total costs of the CPU with integrated processing, optical storage, and workstations are presented in Table A-1. The equipment will be purchased during Project Year 3 (FY88) and Project Year 4 (FY89).

With an assumed eight-year useful life, the ADP equipment will have to be replaced in Project Year 13 at a cost of $10,100,000.

b. Site Preparation[8]. For Alternative B, the physical location of equipment at the centers will be determined by each Center's management. Specially prepared space will be required for the computer equipment operations. There also will be costs associated with installation of lines required to connect the ADP equipment such as costs for surge suppressors with an adequate number of plugs to all workstation hardware. These preparation costs are estimated to be $200,000 in Project Year 3 (FY88) and $240,000 in Project Year 4 (FY89)[8].

[redacted]

[redacted]	[redacted][2]	[redacted][3]							
		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

c. System Development

(1) Contractor support. Contractor support costs for Alternative B are estimated to be $200,000 in Project Year 1 (FY86)[8,10]. These costs include assistance in system design/development and personnel training costs for DSAC personnel.

(2) In-House services. Alternative B costs for services provided by DSAC, DLSC, and the Centers include system design, system analysis, programming, equipment procurement, and training. The estimated costs are provided in Table A-2.

Table A-2

IN-HOUSE SERVICE COSTS[8]

Project Year	DSAC	PSE/DSC
1	$ 210,000	$ 80,000
2	890,000	130,000
3	900,000	130,000
4	200,000	80,000
Totals	$2,200,000	$420,000

(3) Travel. An estimated $50,000[8] per year for Project Years 1 through 4 will be required for travel between DLA Headquarters, DSAC, DLSC, DPSC, and the four hardware centers. The first four years of the project will require frequent trips for in-process reviews and Functional Project Development Group meetings.

d. Residual Value. In Project Year 15, both alternatives will have residual values for equipment replaced. For Alternative A, the remaining useful life of the equipment replaced in Project Year 11 is three years. Thus, the residual value of the equipment in Project Year 15 is 3/8 x $350,000 = $131,250. For Alternative B, the remaining useful life of the equipment replaced in Project Year 13 is five years. Thus, the residual value of the equipment in Project Year 15 is 5/8 x $10,100,000 = $6,313,000.

2. Recurring Costs/Cost Savings

a. Personnel

(1) Personnel requirement determination. To determine personnel requirements, first, the current number of personnel employed in each activity of the Cataloging Division is determined[5,15]. Second, the

number of personnel saved by implementing the AIS proposal is computed based upon the elimination of required activities and the subsequent reduction in personnel requirements. These activities include document routing and control, data entry, and quality control[2]. The difference between current personnel requirements and personnel saved gives the personnel requirements for the AIS proposal. Table A-3 provides a breakdown of personnel requirements by center for both alternatives as well as the personnel saved if the AIS is implemented.

Table A-3[15]

PERSONNEL REQUIRED/SAVED

Center	Personnel Requirements Alternative A	Personnel Saved Alternative B	Personnel Requirements Alternative B
DCSC	116	36	80
DESC	145	38	107
DGSC	78	17	61
DISC	77	33	44
DPSC	96	15	81
TOTALS	512	139	373

(2) Personnel cost determination

It is determined that the GS-7 level, step 4[10], salary of $19,606[14] should be used for computing Item Identification and Cataloging personnel costs. In addition, fringe benefits are to be computed using the current DLA rate of 36.2% of salary[3]. Management overhead is determined to be 10% of salary[10]. Thus, personnel costs are calculated as follows:

Personnel costs = number of personnel x salary + (fringe benefit % + management overhead %) x salary

Tables A-4 through A-6 provide personnel costs for both alternatives and for personnel costs savings if Alternative B is implemented.

The ADP equipment will be installed in FY88 and FY89. The equipment will be only partially operational during this time and, thus, the cost savings are prorated for these two years. Five percent of the personnel cost savings will be realized in Project Year 3 (FY88) under Alternative B, 50% of the personnel cost savings in Project Year 4 (FY89), and 100% of the personnel cost savings thereafter[10]. Table A-7 shows calculations for personnel costs and cost savings by project year.

b. Software Maintenance. In addition to initial software purchase costs under Alternative B, there will be recurring costs of $20,000 annually for maintaining software[9] by DLA headquarters and DSC personnel.

TABLE A-4
PERSONNEL COSTS/YEAR
ALTERNATIVE A

CENTER	PERSONNEL REQUIRED	SALARY	UNADJUSTED TOT SALARY	ACCELERATE FACTOR *	PERSONNEL COSTS
DCSC	116	19,606	2,274,296	1.462	3,325,021
DESC	145	19,606	2,842,870	1.462	4,156,276
DGSC	78	19,606	1,529,268	1.462	2,235,790
DISC	77	19,606	1,509,662	1.462	2,207,126
DPSC	96	19,606	1,882,176	1.462	2,751,741
DLA	512		10,038,272		14,675,954

TABLE A-5
PERSONNEL COSTS/YEAR
ALTERNATIVE B

CENTER	PERSONNEL REQUIRED	SALARY	UNADJUSTED TOT SALARY	ACCELERATE FACTOR *	PERSONNEL COSTS
DCSC	80	19,606	1,568,480	1.462	2,293,118
DESC	107	19,606	2,097,842	1.462	3,067,045
DGSC	61	19,606	1,195,966	1.462	1,748,502
DISC	44	19,606	862,664	1.462	1,261,215
DPSC	81	19,606	1,588,086	1.462	2,321,782
DLA	373		7,313,038		10,691,662

TABLE A-6
PERSONNEL SAVINGS/YEAR

CENTER	PERSONNEL SAVED	SALARY	UNADJUSTED TOT SALARY	ACCELERATE FACTOR *	PERSONNEL SAVINGS
DCSC	36	19,606	705,816	1.462	1,031,903
DESC	38	19,606	745,028	1.462	1,089,231
DGSC	17	19,606	333,302	1.462	487,288
DISC	33	19,606	646,998	1.462	945,911
DPSC	15	19,606	294,090	1.462	429,960
DLA	139		2,725,234		3,984,292

*ACCELERATION FACTOR = 1.362 FOR FRINGE BENEFIT ADJUSTMENT + .10 FOR MANAGEMENT OVERHEAD COST ADJUSTMENT

c. Equipment Maintenance

For Alternative A, the maintenance costs are for the Four-Phase computers. Defense Electronics Supply Center (DESC) identified the annual maintenance costs for this equipment as $18,600[2]. Since the Four-Phase system is in effect at the hardware centers and DPSC, the annual maintenance costs are 5 x $18,600 or approximately $93,000.

Table A-7

PRORATION OF PERSONNEL COSTS/COST SAVINGS

Project Year	Alternative A Personnel Costs	Alternative B Personnel Costs	Personnel Savings
1-2	$14676K	$14676K	0
3	$14676K	$14676K - 199K $14477K	.05 x $3984K $199K
4	$14676K	$14676K - 1992K $12684K	.50 x $3984K $1992K
5-10	$14676K	$10692K	$3984K

For Alternative B, the minicomputers and workstations will have to be maintained. In Project Year 3 (FY88), the computer equipment will be partially installed, and the maintenance costs for the computer equipment are estimated to be $20,000. In Project Year 4 (FY89), installation of all equipment will be completed. Thus, beginning in Project Year 4, annual maintenance costs are estimated to be $200,000[8].

d. Travel. For Alternative B, these costs include air transportation between DLA Headquarters, the DSCs, DPSC, DLSC, and DSAC plus lodging, meals, and local transportation. Starting in Project Year 5 (FY90), travel costs will be approximately $2,000 annually[8].

e. Supplies. Annual costs for supplies for both alternatives are estimated to be approximately the same. Supplies for Alternative A include packets, forms, microfilm, and hardcopy paper. Supplies for Alternative B include laser disks and other computer supplies. DESC annual supply costs .pa (FY84) were $5,000[2]. Thus, the supply costs are estimated at 5 x $5,000 or $25,000 annually for both alternatives[2,15].

ECONOMIC ANALYSIS - DoD INVESTMENTS

FORMAT A-1

Summary of Project Costs ($000)

1. Submitting DoD Component: Defense Logistics Agency (HQ)
2. Date of Submission: 4 August 1986
3. Project Title: CTOL AIS EA
4. Description of Project Objective: Improve Processing Times, Work Quality & Control
5a. Present Alternative: Current Operations — 6a. Economic Life: —
b. Proposed Alternative: CTOL AIS — b. Economic Life: 11 years

7	8 RECURRING (Operations) Costs		9	10	11
PROJECT YEAR	a PRESENT ALTERNATIVE	b PROPOSED ALTERNATIVE	DIFFERENTIAL COST	DISCOUNT FACTOR	DISCOUNTED DIFFERENTIAL COST
1	14794	14794	0	.954	0
2	14794	14794	0	.867	0
3	14794	14615	179	.788	141
4	14794	12909	1885	.717	1352
5	14794	10939	3855	.651	2510
6	14794	10939	3855	.592	2282
7	14794	10939	3855	.538	2074
8	14794	10939	3855	.489	1885
9	14794	10939	3855	.445	1715
12. TOTALS	CONTINUED	CONTINUED	CONTINUED	CONTINUED	CONTINUED

13. PRESENT VALUE of NEW INVESTMENT:
- a. Land and Buildings —
- b. Equipment —
- c. Other (Identify nature) —
- d. Working Capital (Change — plus or minus) —

14. Total Present Value of New Investment (i.e., Funding requirements) —
15. PLUS: Value of Existing Assets to be Employed on the Project —
16. LESS: Value of Existing Assets Replaced —
17. LESS: Discounted Terminal Value of New Investment —
18. Total New Present Value of Investment —
19. Present Value of Cost Savings from Operations (Col. 11) —
20. PLUS: Present Value of the Cost of Refurbishment or Modification Eliminated —
21. Total Present Value of Savings —
22. Savings/Investment Ratio (Line 21 divided by Line 18) —
23. Rate of Return on Investment —

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ECONOMIC ANALYSIS - DoD INVESTMENTS — FORMAT A-1

Summary of Project Costs ($000)

1. Submitting DoD Component: _____
2. Date of Submission: _____
3. Project Title: _____
4. Description of Project Objective: _____
5a. Present Alternative: _____ 6a. Economic Life: _____
b. Proposed Alternative: _____ b. Economic Life: _____

7	8 RECURRING (Operations) Costs		9	10	11
	a	b			
PROJECT YEAR	PRESENT ALTERNATIVE	PROPOSED ALTERNATIVE	DIFFERENTIAL COST	DISCOUNT FACTOR	DISCOUNTED DIFFERENTIAL COST
10	14794	10939	3855	.405	1561
11	14794	10939	3855	.368	1419
12	14794	10939	3855	.334	1288
13	14794	10939	3855	.304	1172
14	14794	10939	3855	.276	1064
15	14794	10939	3855	.251	968
12. TOTALS	221910	177441	44469		19431

13. PRESENT VALUE of NEW INVESTMENT:
a. Land and Buildings ---------- $10,447
b. Equipment ---------- 3,047
c. Other (Identify nature) SITE PREPARATION, SYSTEM DEVELOPMENT ---------- 0
d. Working Capital (Change — plus or minus) ---------- 13,494
14. Total Present Value of New Investment (i.e., Funding requirements) ---------- 0
15. PLUS: Value of Existing Assets to be Employed on the Project ---------- 0
16. LESS: Value of Existing Assets Replaced ---------- 1,585
17. LESS: Discounted Terminal Value of New Investment ---------- 11,909
18. Total New Present Value of Investment ---------- 19,431
19. Present Value of Cost Savings from Operations (Col. H) ---------- 96
20. PLUS: Present Value of the Cost of Refurbishment or Modification Eliminated ---------- 19,527
21. Total Present Value of Savings ----------
22. Savings/Investment Ratio (Line 21 divided by Line 18) 1.64
23. Rate of Return on Investment ----------

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* U.S. GOVERNMENT PRINTING OFFICE: 1984 784-088/7481

APPENDIX C

References

1. Application Study, Cataloging Tools On-Line, DLA Systems Automation Center (DSAC), Control Number A908.

2. Accelerated Cataloging/Mechanized Entry (ACME) Feasibility and Cost Benefit Analysis, Final Report, 2 February 1984, Office of Telecommunications and Information Systems (OTIS).

3. Economic Analysis, DLAM 7041.1, May 1985, Chapter 3 (p. 2), Chapter 5 (pp. 1-4), Chapter 13 (pp. 1-2), Chapter 14 (pp. 1-3).

4. Economic Analysis for Decision Making, U. S. Army Mangement Engineering Training Agency, January 1985, Chapters 7-8 (pp. 71-101).

5. Cataloging Tools On-Line Functional Description, DSAC, 4 December 1985.

6. ADP Systems Engineering/Technical Support Services, SAMMS Modernization Preliminary Economic Analysis, Final Report, OTIS.

7. Office of Management and Budget Circular No. A-94 (Revised), 27 March 1972, "Discount Rates to be Used in Evaluating Time-Distributed Costs and Benefits."

8. DLA-ZSM, Dennis Heretick correspondence, July 1986.

9. "System Analysis and Requirements Document (SARD) for Cataloging Tools On-Line (CTOL)", 27 February 1986, DSAC-OF.

10. SAMMS-M Project Development Plan, 1 December 1985.

11. DLA-OSS, Telephone conversation between J. W. Richman and Jan Rider, August 1986.

12. "Management Cost Account Structure", DLAM 7000.1, Change 10, P400 Accounts.

13. DLA Management Engineering Standards (DIMES), November 1983.

14. Office of Personnel Management, Pay Table for General Schedule (GS) Grades for Those Paid Every Two Weeks.

15. DLA-OSS, Telephone conversations between Dennis Heretick and Jan Rider, August 1986.

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